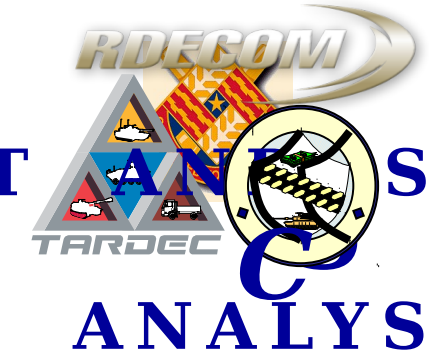
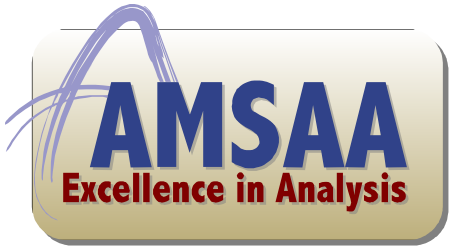
Joint Light Tactical Vehicle (JLTV) Analysis of Alternatives (AoA)





T ANALYSIS SYSTEMS

C ANALYSIS

49th Army Operations Research Symposium

Fort Lee, VA

13 – 14 October 2010

Distribution Statement A: Approved for public release; distribution is unlimited.

Purpose and Agenda

Purpose: To present an overview of the Joint Light Tactical Vehicle (JLTV) Analysis of Alternatives (AoA) and review the analysis completed to date.

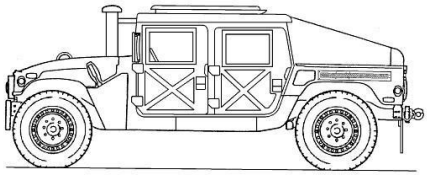
Agenda:

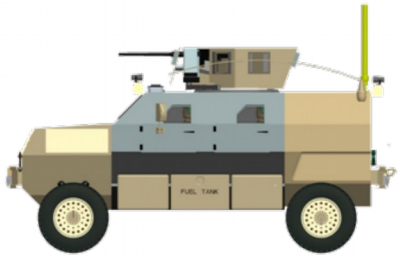
- Study Context.
- Analysis Insights to Date.
- Schedule.
- Summary and Way Ahead.

Study Objective: Provide cost and operational effectiveness analysis of alternative tactical vehicle options to inform program requirements and the JLTV Milestone B Acquisition Decision in 4Q Fiscal Year 2011.

Background

- There are approximately *120,000 High Mobility Multi-purpose Wheeled Vehicles (HMMWV)* across DoD serving in combat, combat service, and combat service support roles.
- HMMWV have undergone numerous modifications to enable their use in current operations, including the addition of armor protection, to increase force protection and survivability.
- The effect of these modifications has exacerbated capability gaps in *mobility, reliability, and operational flexibility*, leading to:
  - Reduced payload capacity (due to armor weight).
  - Fuel inefficiency.
  - Decreased vehicle stability/safety.
  - Decreased operational a





The HMMWV platform may not adequately meet the operational requirements of future warfighting concepts.

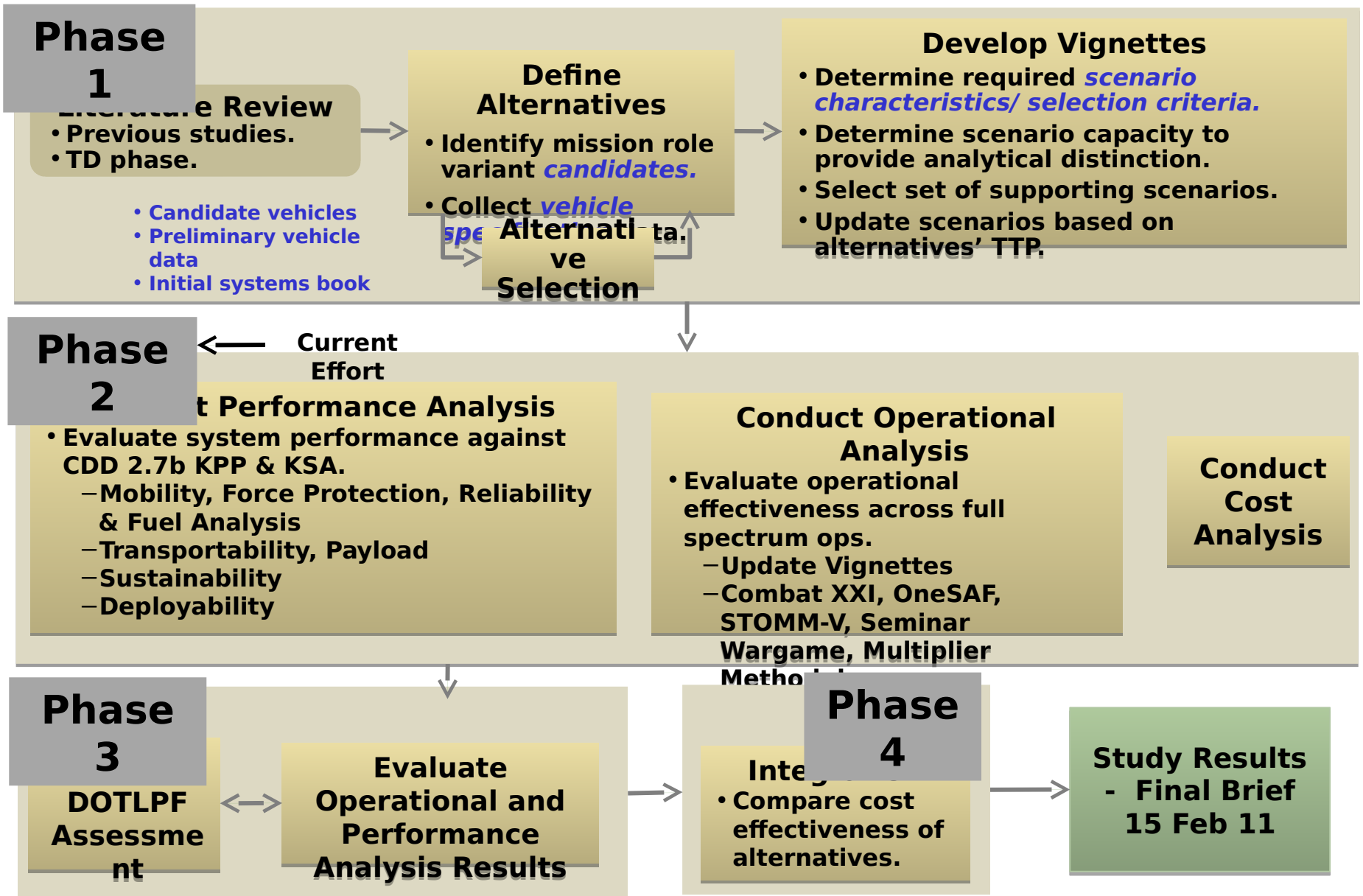
Study Issues

- What is the *operational effectiveness* of each alternative across the spectrum of operations?
- How well does each alternative satisfy the *key performance parameters* (KPPs)?
- What are the trade-offs among force *protection, performance, and payload*, considering both cost and effectiveness?
- If a KPP and/or key system attribute (KSA) is particularly costly or difficult to achieve, what are the implications of modifying the *performance characteristics* in question?
- For each alternative, what are the *doctrine, organization, training, leadership and education, and personnel and facilities* (DOTLPF) implications for each of the Services?
- What are the *operational implications* of JLTV being assigned mission roles currently assigned to larger, heavily-protected, wheeled, tactical vehicles?
- What is the *life-cycle cost* of fielding each JLTV alternative?
- What is the *cost-effectiveness* of the alternatives?
- What are the fuel demands using the *fully burdened cost of fuel* (FBCF) methodology?

Key Constraints, Limitations, & Assumptions

- Constraints:
  - Time: provide results by Feb 2011.
- Limitations:
  - CDD version 2.7b will be used; all subsequent changes to requirements will be addressed on a case-by-case basis.
  - Given the large number of vehicles in the initial candidate set (27) of mission role variants (MRVs), the analysis will consider a sub-set of representative MRVs for each alternative.
- Assumptions:
  - Vehicle quantities used for costing will reflect the Services' Tactical Wheeled Vehicle (TWV) Strategy.
  - AMSAA-certified surrogate data will provide a sufficient representation of new start RAM and performance data as informed by technology demonstration (TD) data.
  - Life-cycle costs reflect a peacetime OPTEMPO. Fully burdened cost of fuel (FBCF) analysis will consider peacetime OPTEMPO and wartime operations.

Methodology


Phase 1
Literature Review
• Previous studies.
• TD phase.
• Candidate vehicles
• Preliminary vehicle data
• Initial systems book
Define Alternatives
• Identify mission role variant candidates.
• Collect vehicle spe ta.
Develop Vignettes
• Determine required scenario characteristics/ selection criteria.
• Determine scenario capacity to provide analytical distinction.
• Select set of supporting scenarios.
• Update scenarios based on alternatives' TTP.
Alternati ve Selection
Phase 2
Current Effort
t Performance Analysis
• Evaluate system performance against CDD 2.7b KPP & KSA.
– Mobility, Force Protection, Reliability & Fuel Analysis
– Transportability, Payload
– Sustainability
– Deployability
Conduct Operational Analysis
• Evaluate operational effectiveness across full spectrum ops.
– Update Vignettes
– Combat XXI, OneSAF, STOMM-V, Seminar Wargame, Multiplier Metho
Conduct Cost Analysis
Phase 3
DOTLPF Assessme nt
Evaluate Operational and Performance Analysis Results
Phase 4
Inte
• Compare cost effectiveness of alternatives.
Study Results - Final Brief 15 Feb 11

Candidate Vehicles

Alternatives were prescribed by HQDA with the addition of a special interest vehicle requested by MCCDC.

Mission Role Variant (MRV)	Base Case	PIP	ALT 1	ALT 2
	FY 2013 LTVs	PIP'd HMMWV	COTS	NEW START
General Purpose Vehicle (GPA - Cat A)	Armament Carrier (M1025) Expanded Capacity (M1113, M1152) C2/General Purpose Vehicle (M1165)	SCTVC GPA	Cougar 4x4 ISS M-ATV IVECO	JLTV GPA
Combat Tactical Vehicle (CTV – Cat B)	TOW Carrier (M966) Armament Carrier (M1025, M1151) Cargo/Troop Carrier (M1038)	SCTVC CTV	M-ATV Cougar 4x4 ISS Cougar 6x6 ISS MaxxPro Base MaxxPro Base +MEAP MaxxPro Plus MaxxPro Dash RG-31	JLTV CTV
Utility Vehicle (UV – Cat C)	Shelter Carrier (M1037, 1097) Cargo/Troop Carrier (M1038, M998) Expanded Capacity (M1113, M1152)	SCTVC UV	Cougar 4x4 ISS RG-33 USSOCOM AUV	JLTV UV

Selection Criteria Attributes

Process

1. The study team analyzed base case and alternative one candidate vehicles by mission role variant (MRV).
2. Selection process used the *tier one criteria* (highlighted in yellow) for each MRV.

3. Vehicles that failed to meet tier one criterion were removed from further consideration.
4. Selection process used the *tier two criteria* (highlighted in orange) to further refine the list of vehicles and eliminate ties.

KPP	Attributes for Measurement	Category		
		A (GPA)	B (CTV)	C (UV)
Mobility	**Off –Road Mobility**: ground clearance, ground pressure, articulation/travel			
	Maneuverability: turning diameter, static-stability factor (rollover propensity)			
	Propulsion: speed, longitudinal slope (climb capability), power to weight ratio			
Force Protection (Occupants)	**Small Arms Threat** (Warfighting Expert)			
	IED Side Threat (Warfighting Expert)			
	Under Vehicle IED Threat (Warfighting Expert)			
Payload	**Gross Vehicle Weight Rating (GVWR)**			
Survivability	Not Addressed			
Availability	**Mean Miles Between Operational Mission Failures (MMBOMF)**			
Transportabilit	**Weight**: Combat weight of vehicle including personnel and full			

Tier one criterion Tier two criterion

Selection Results – Base Case

Category A – GPA: Focused on Force Protection, Transportability and Mobility.

- Armament Carrier (M1025) - Eliminated due to lack of force protection.
- Expanded Capacity (M1113) - Eliminated as it is being replaced by the M1152.
- Expanded Capacity (M1152) - Eliminated due to less mobility (maneuverability) than M1165; M1152 (2 man crew & shelter) has higher roll over propensity than M1165 (4-man crew).
- GPA Selected:
  - ✓ *C2/General Purpose Vehicle (M1165)* - Met selection criteria; rotary wing transportable with relaxed CH-47F requirement.

Category B – CTV: Focused on Force Protection and Mobility.

- TOW Carrier (M966), Armament Carrier (M1025) and Troop/Cargo Carrier (M1038) - Eliminated due to lack of force protection.
- CTV Selected:
  - ✓ *Armament Carrier (M1151)* - Met selection criteria.

Category C – UV: Focused on Force Protection and Payload.

- Shelter Carrier (M1037, M1097) and Cargo/Troop Carrier (M1038, M998) - Eliminated due to lack of force protection.
- Expanded Capacity (M1113) - Eliminated as it is being replaced by the M1152.
- UV Selected:
  - ✓ *Expanded Capacity (M1152)* - Met selection criteria.

Selection Results – Alternative One

Category A – GPA: Focused on Force Protection, Transportability and Mobility.

- Cougar 4x4 ISS, M-ATV - Eliminated due to inability to be transported via rotary wing.
- GPA Selected:
  - ✓ *IVECO* - Met selection criteria.

Category B – CTV: Focused on Force Protection and Mobility.

- MaxxPro Base, MaxxPro Base + MEAP, MaxxPro Plus, MaxxPro Dash, Cougar 6x6, RG-31, Cougar ISS - Eliminated due to less mobility than the M-ATV.
- CTVs Selected:
  - ✓ *M-ATV* - Met force protection and mobility selection criteria.

Category C – UV: Focused on Force Protection and Payload. Mobility and Availability (MMBOMF) were tier two criteria.

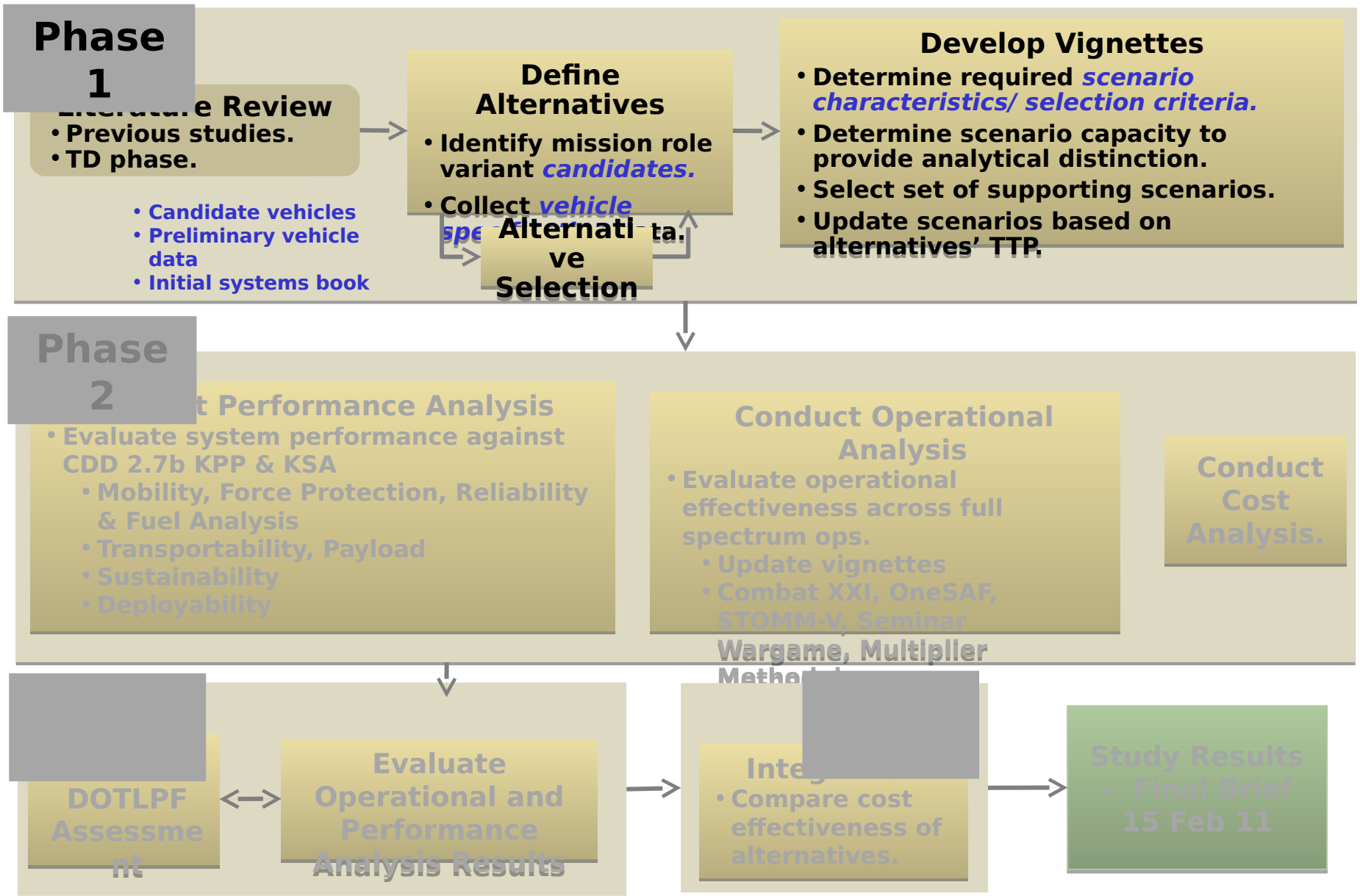
- Both vehicles considered met force protection and payload selection criteria.
- UV Selected:
  - ✓ *Cougar 4x4 ISS* - Highest tier one and tier two values.

Post Selection Study Alternatives

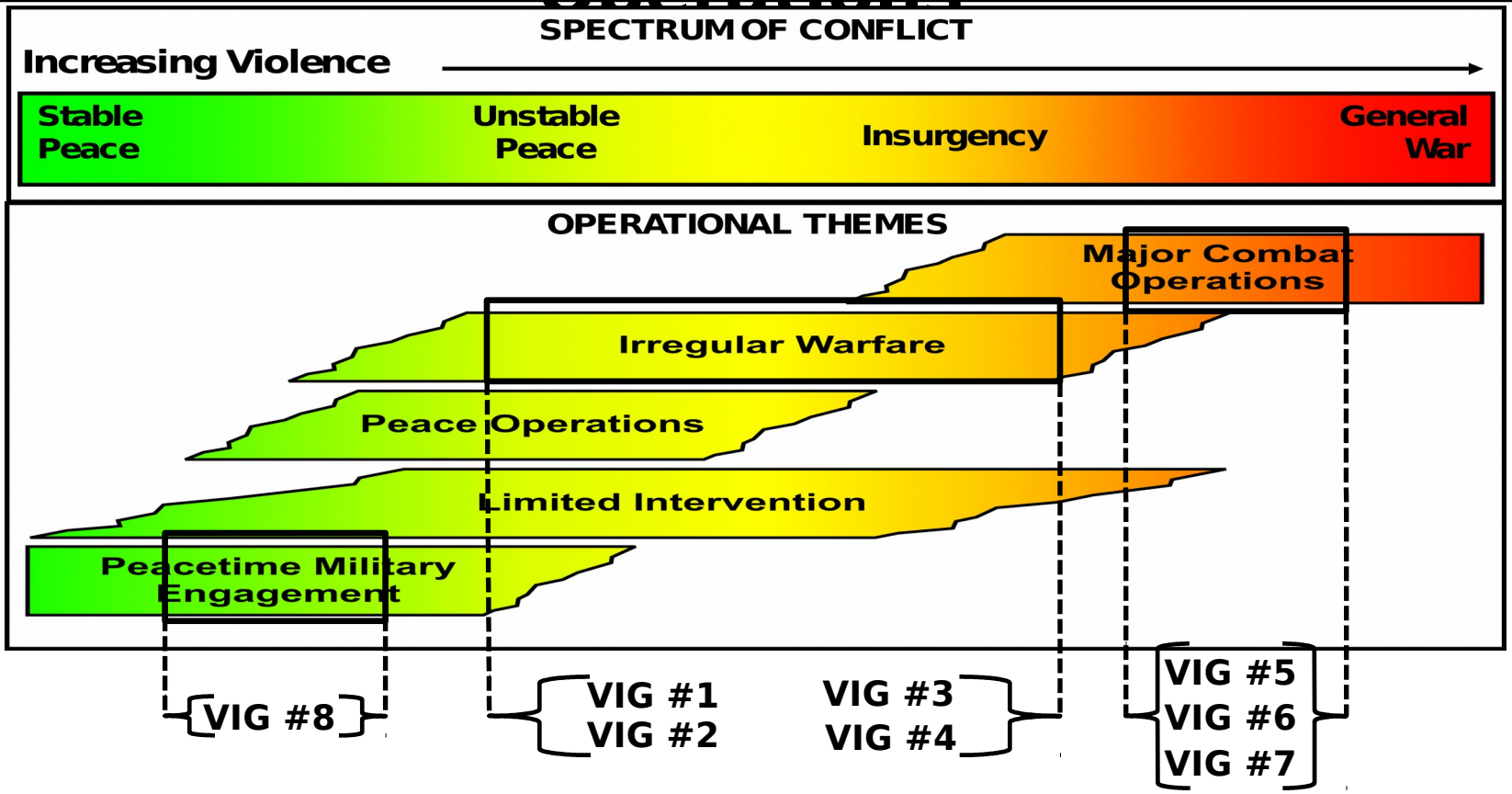
Vehicles recommended for further analysis in the AoA based on the two tier selection process.

Mission Role Variant (MRV)	Base Case	PIP	ALT 1	ALT 2
	FY 2013 LTVs	PIP'd HMMWV	COTS	NEW START
General Purpose Vehicle (GPA - Cat A)	Armament Carrier (M1025) Expanded Capacity (M1113, M1152) C2/General Purpose Vehicle (M1165)	SCTVC GPA	Cougar 4x4 ISS M-ATV IVECO	JLTV GPA
Combat Tactical Vehicle (CTV – Cat B)	TOW Carrier (M966) Armament Carrier (M1025, M1151) Cargo/Troop Carrier (M1038)	SCTVC CTV	M-ATV Cougar 4x4 ISS Cougar 6x6 ISS MaxxPro Base MaxxPro Base +MEAP MaxxPro Plus MaxxPro Dash RG-31	JLTV CTV
Utility Vehicle (UV - Cat C)	Shelter Carrier (M1037, 1097) Cargo/Troop Carrier (M1038, M998) Expanded	SCTVC UV	Cougar 4x4 ISS RG-33 USSOCOM AUV	JLTV UV

Methodology


Phase 1
Literature Review
• Previous studies.
• TD phase.
• Candidate vehicles
• Preliminary vehicle data
• Initial systems book
Define Alternatives
• Identify mission role variant candidates.
• Collect vehicle
Develop Vignettes
• Determine required scenario characteristics/ selection criteria.
• Determine scenario capacity to provide analytical distinction.
• Select set of supporting scenarios.
• Update scenarios based on alternatives' TTP.
Alternative Selection
Phase 2
Performance Analysis
• Evaluate system performance against CDD 2.7b KPP & KSA
• Mobility, Force Protection, Reliability & Fuel Analysis
• Transportability, Payload
• Sustainability
• Deployability
Conduct Operational Analysis
• Evaluate operational effectiveness across full spectrum ops.
• Update vignettes
• Combat XXI, OneSAF, STOMM-V, Seminar Wargame, Multiplier
Conduct Cost Analysis.
DOTLPF Assessment
Evaluate Operational and Performance Analysis Results
• Compare cost effectiveness of alternatives.
Study Results - Final Brief 15 Feb 11

Operational Analysis – Full Spectrum Operations



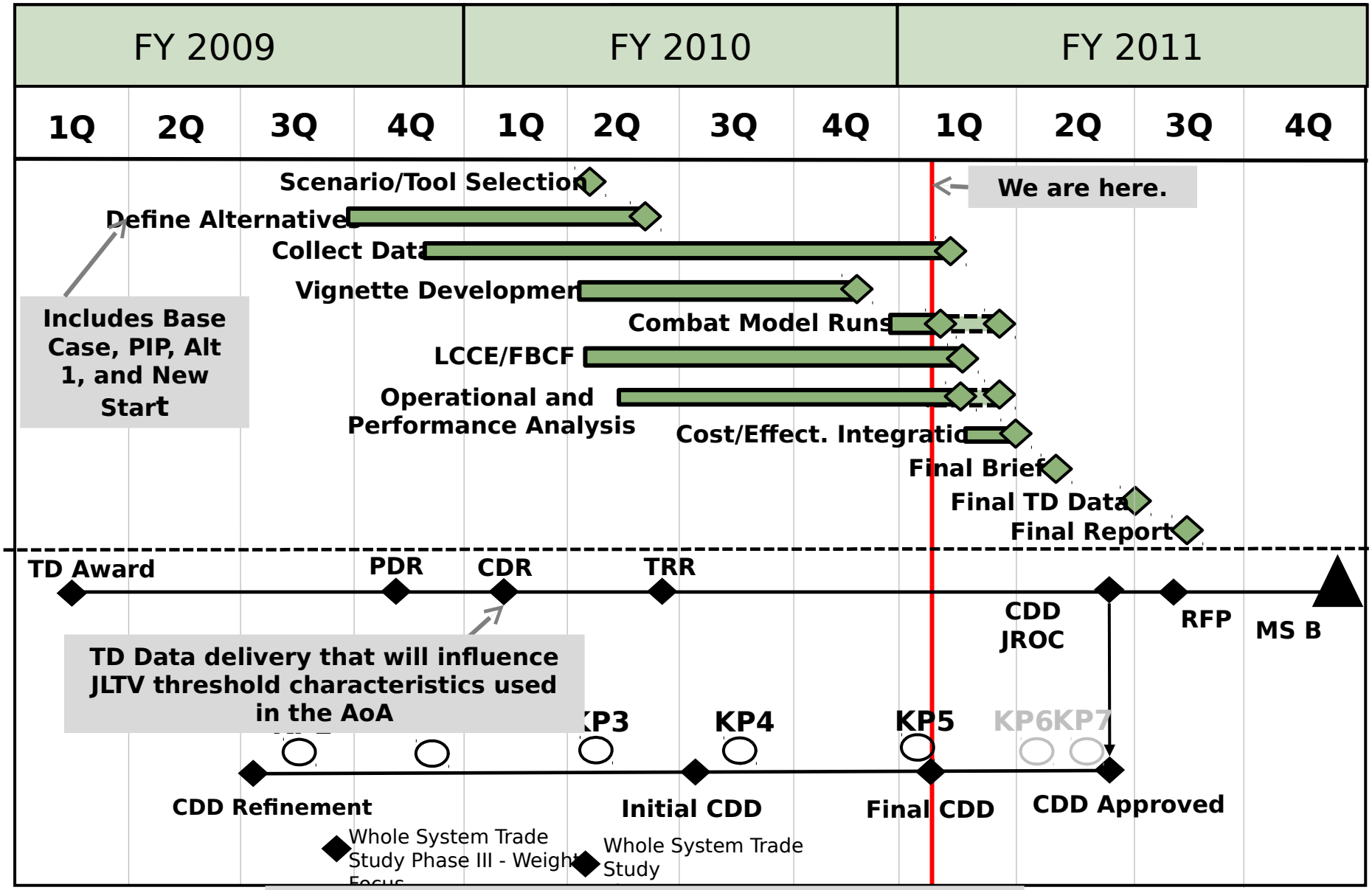
Vignettes developed for the operational analysis:

- Cover the full spectrum of operations.
- Represent all 22 mission tasks identified for light tactical vehicles.
- Provide appropriate measurement space.

Vignettes

Vignette	Short Name	Mission	Location	Terrain
1	**OIF-like MEDCAP and Hasty Raid**	**Mission 1:** Platoon conducts a ***MEDCAP*** to local school and is attacked en route from a complex ambush. Tip leads to a HVI responsible for planning this and other attacks. **Mission 2:** Another platoon conducts a ***hasty raid*** based on tip. **Mission 3:** Another platoon conducts ***route clearance*** operations.	SWA	Flat rural and urban
2	**OEF Deliberate Raid**	**Mission 1:** Company conducts a ***deliberate raid*** on a suspected bomb-making site. **Mission 2:** Platoon conducts ***route security*** to support raid and gets attacked, requiring the raid force to take alternate routes.	SWA	Flat rural and urban
3	**NEA Security Patrol and QRF**	**Mission 1:** Platoon conducts ***convoy security*** along MSR. As they are escorting a convoy, they are attacked by mix of short and long range threats. **Mission 2:** ***QRF*** platoon is activated to attack ambushing threat.	NEA	Rolling woodland
4	**NEA Defense**	**Mission 1:** Company conducts ***mobile defense*** in support of a BN retrograde.	NEA	Rolling woodland
5a / 5b	**SWA Air Assault**	**Mission 1:** USMC (a) / USA (b) company ***air assaults*** to conduct a ***deliberate attack***.	SWA	Flat rural
6	**Amphibious Assault**	**Mission 1:** Battalion landing teams (BLTs) conduct an ***amphibious assault*** to seize chokepoints along critical LOCs.	SWA	Littoral
7	**MCO**	**Mission 1:** IBCT conducts mounted ***road march*** IOT secure AO. **Mission 2:** Platoon conducts ***mounted reconnaissance*** once AO is secured and is ambushed. ***QRF*** then ***air assaults*** to support platoon.	CONUS-based	Complex and Urban
8	**Homeland**	**Mission 1:** Platoon conducts civilian evacuation from contaminated area.		

Schedule


FY 2009
FY 2010
FY 2011
1Q 2Q 3Q 4Q 1Q 2Q 3Q 4Q 1Q 2Q 3Q 4Q
Scenario/Tool Selection
We are here.
Define Alternative
Collect Data
Vignette Developmen
Combat Model Runs
LCCE/FBCF
Operational and Performance Analysis
Cost/Effect. Integratio
Final Brief
Final TD Data
Final Report
Includes Base Case, PIP, Alt 1, and New Start
TD Award
PDR
CDR
TRR
CDD JROC
RFP
MS B
TD Data delivery that will influence JLTV threshold characteristics used in the AoA
KP3
KP4
KP5
KP6KP7
CDD Refinement
Initial CDD
Final CDD
CDD Approved
Whole System Trade Study Phase III - Weight Focus
Whole System Trade Study
Critical Design Review (CDR) / Test Readiness Review (TRR) / Knowledge

Summary and Way Ahead

Summary

- Selection process resulted in a *reduced set of candidate vehicles*.
- *Force protection and transportability* were the two biggest discriminating factors in reducing the set of candidate vehicles.
- Vignettes have been developed to represent the *operational context* in which the vehicles are employed and provide *measurement space* to discriminate between the alternatives.

Way Ahead

- Continue to conduct operational, performance, and cost analyses by:
  - Comparing the performance of the alternatives across mission sets and in an operational environment.
  - Identifying which vehicles perform best against the defined attributes.
  - Assessing the cost effectiveness of the alternatives.
- Present final results by February 2011 to inform program